



PSMN012-100YL

N-channel 100 V, 12 mΩ logic level MOSFET in LFPAK56

20 October 2016

Product data sheet

1. General description

Logic level N-channel MOSFET in an LFPAK56 (Power SO8) package using TrenchMOS technology. This product is designed and qualified for use in a wide range of power supply & motor control equipment.

2. Features and benefits

- Advanced TrenchMOS provides low R_{DSon} and low gate charge
- Logic level gate operation
- Avalanche rated, 100 % tested
- LFPAK provides maximum power density in a Power SO8 package

3. Applications

- Synchronous rectification in power supply equipment
- Chargers & adaptors with $V_{out} < 10$ V
- Fast charge & USB-PD applications
- Battery powered motor control
- LED lighting & TV backlight

4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | - | - | 100 | V |
| I_D | drain current | $V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2 | - | - | 85 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | - | - | 238 | W |
| Static characteristics | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11 | - | 9.5 | 12 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $I_D = 25\text{ A}$; $V_{DS} = 80\text{ V}$; $V_{GS} = 5\text{ V}$; $T_j = 25\text{ °C}$; Fig. 13 ; Fig. 14 | - | 24 | - | nC |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|--|---|
| 1 | S | source |  <p>LPAK56; Power-SO8 (SOT669)</p> |  |
| 2 | S | source | | |
| 3 | S | source | | |
| 4 | G | gate | | |
| mb | D | mounting base; connected to drain | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|---------------|----------------------|---|---------|
| | Name | Description | Version |
| PSMN012-100YL | LPAK56; Power-SO8 | Plastic single-ended surface-mounted package (LPAK56; Power-SO8); 4 leads | SOT669 |

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---------------------------|-------------------------|---|-----|-----|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | - | 100 | V |
| V_{DGR} | drain-gate voltage | $R_{GS} = 20\text{ k}\Omega$ | - | 100 | V |
| V_{GS} | gate-source voltage | | -20 | 20 | V |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | - | 238 | W |
| I_D | drain current | $V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2 | - | 85 | A |
| | | $V_{GS} = 5\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 2 | - | 60 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3 | - | 339 | A |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | - | 85 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | - | 339 | A |

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|--|--------|-----|--------|
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 85 \text{ A}$; $V_{sup} \leq 100 \text{ V}$; $R_{GS} = 50 \text{ }\Omega$; $V_{GS} = 5 \text{ V}$; $T_{j(\text{init})} = 25 \text{ }^\circ\text{C}$; unclamped; Fig. 4 | [1][2] | - | 139 mJ |

- [1] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [2] Refer to application note AN10273 for further information.

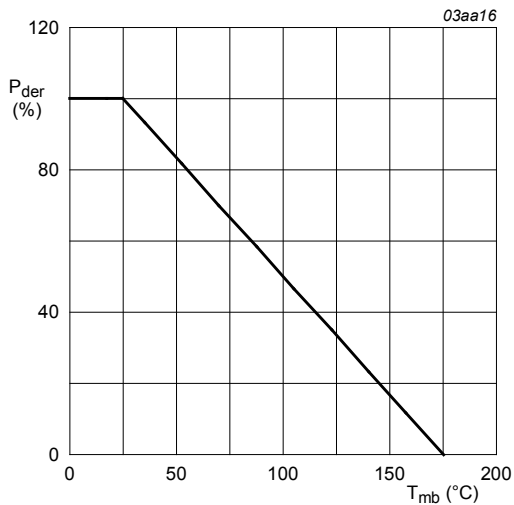


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ\text{C})}} \times 100\%$$

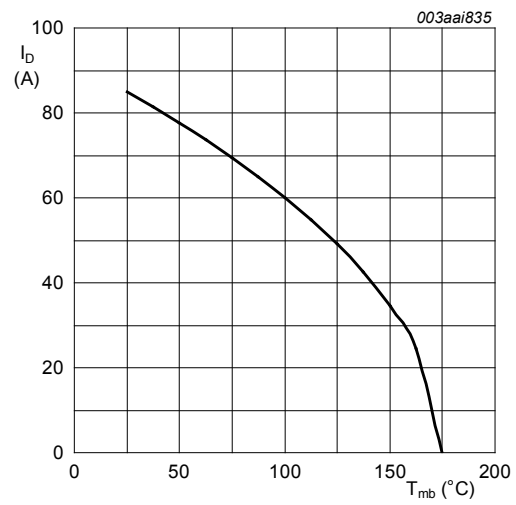


Fig. 2. Continuous drain current as a function of mounting base temperature

$$V_{GS} \geq 5\text{V}$$

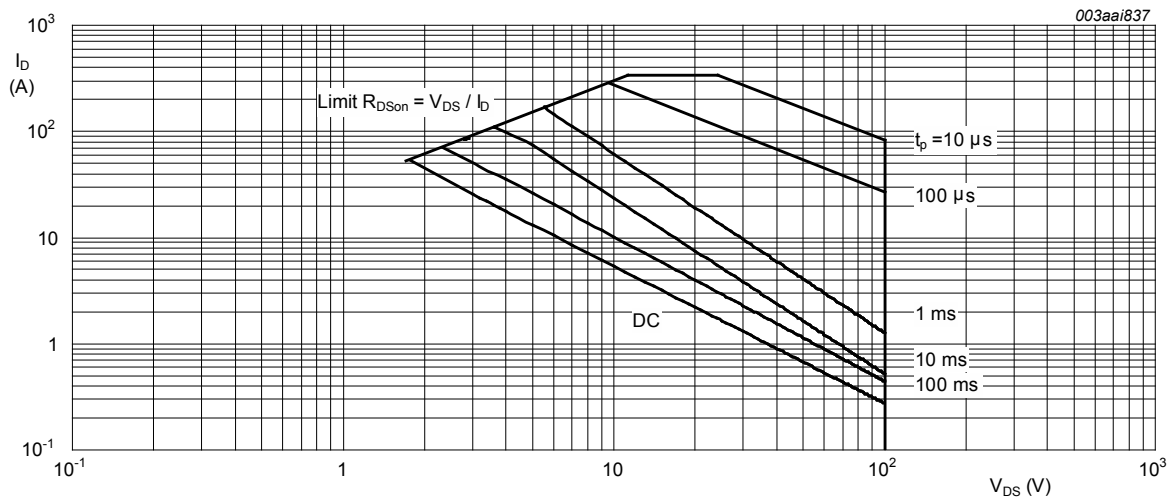


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$$T_{mb} = 25^\circ\text{C}; I_{DM} \text{ is a single pulse}$$

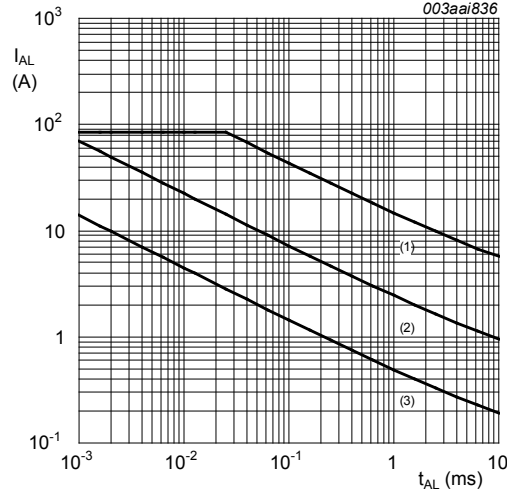


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_j(\text{init}) = 25^\circ\text{C}$; (2) $T_j(\text{init}) = 150^\circ\text{C}$; (3) Repetitive Avalanche

8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|------------|-----|-----|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Fig. 5 | - | - | 0.63 | K/W |

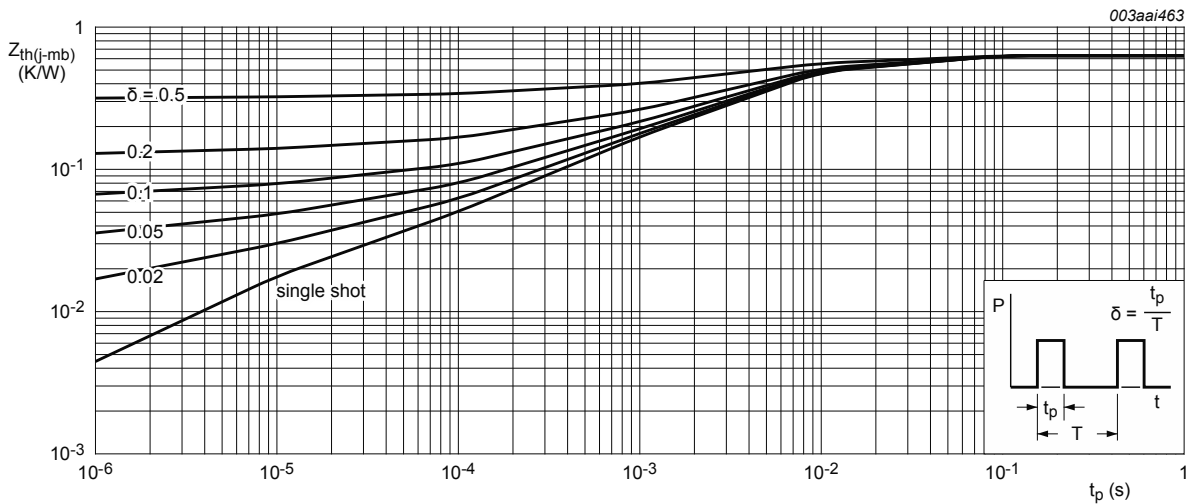


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|-----|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 100 | - | - | V |
| | | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 90 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 9 ; Fig. 10 | 1.4 | 1.7 | 2.1 | V |
| | | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ Fig. 9 | - | - | 2.45 | V |
| | | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ Fig. 9 | 0.5 | - | - | V |
| I_{DSS} | drain leakage current | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.08 | 10 | μA |
| | | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ | - | - | 500 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 11 | - | 9.5 | 12 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 11 | - | 9.1 | 11.9 | mΩ |
| | | $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ Fig. 11 ; Fig. 12 | - | - | 33.1 | mΩ |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 13 ; Fig. 14 | - | 118 | - | nC |
| | | $I_D = 25 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 5 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 13 ; Fig. 14 | - | 64 | - | nC |
| Q_{GS} | gate-source charge | | - | 13 | - | nC |
| Q_{GD} | gate-drain charge | | - | 24 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 15 | - | 5980 | 7973 | pF |
| C_{oss} | output capacitance | | - | 349 | 419 | pF |
| C_{rss} | reverse transfer capacitance | | - | 214 | 293 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 80 \text{ V}; R_L = 3.2 \text{ } \Omega; V_{GS} = 5 \text{ V}; R_{G(ext)} = 5 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 22 | - | ns |
| t_r | rise time | | - | 39 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 117 | - | ns |
| t_f | fall time | | - | 74 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 16 | - | 0.81 | 1.2 | V |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------|-----------------------|---|-----|-----|-----|------|
| t_{rr} | reverse recovery time | $I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; | - | 47 | - | ns |
| Q_r | recovered charge | $V_{DS} = 25\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$ | - | 90 | - | nC |

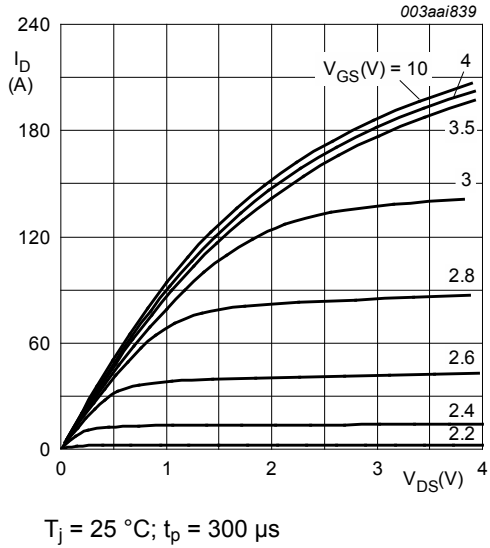


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

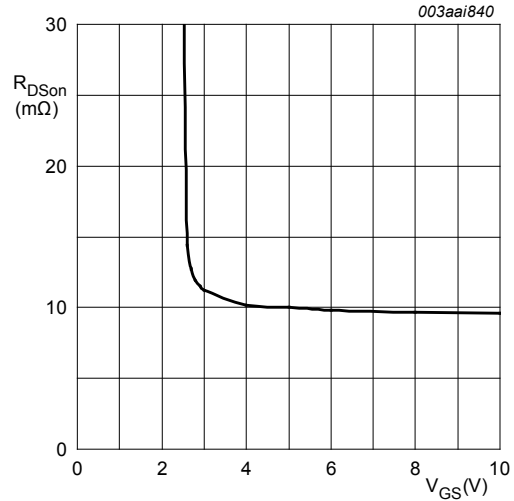


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25\text{ }^\circ\text{C}$; $I_D = 25\text{ A}$

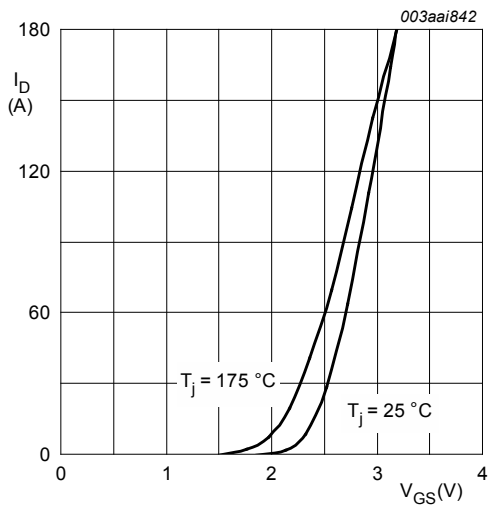


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10\text{ V}$

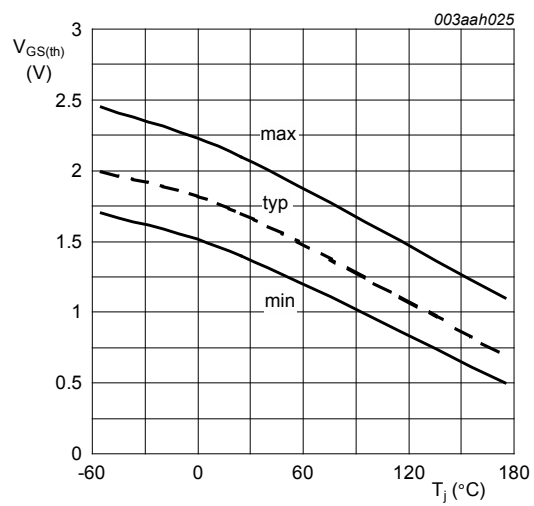


Fig. 9. Gate-source threshold voltage as a function of junction temperature

$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

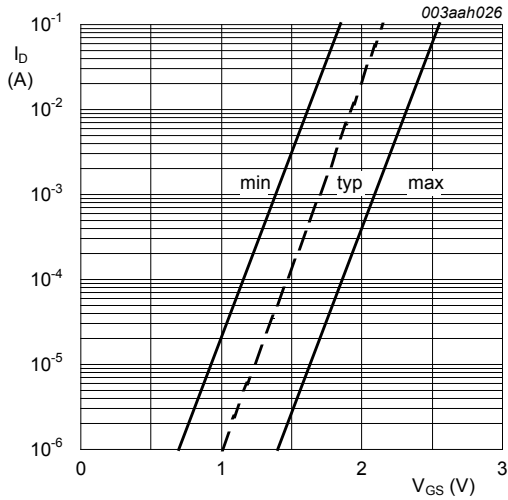
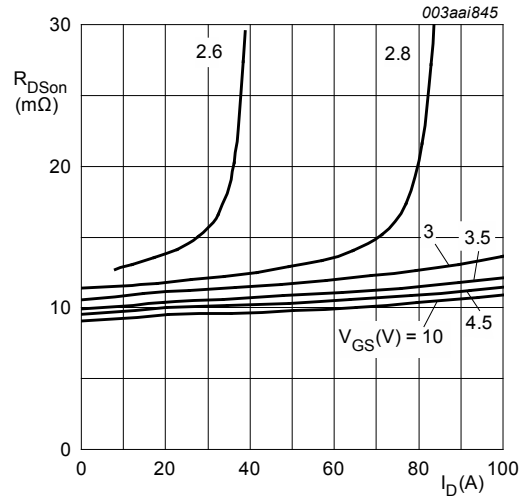


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$$



$$T_j = 25^\circ\text{C}; t_p = 300 \mu\text{s}$$

Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

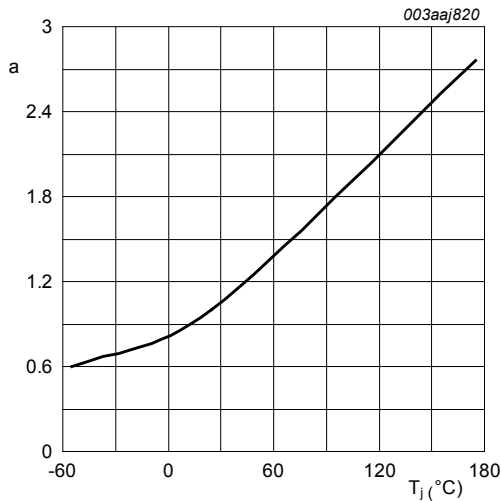


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$

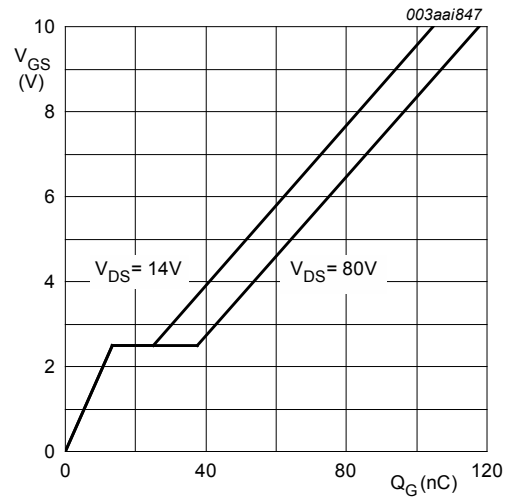


Fig. 13. Gate-source voltage as a function of gate charge; typical values

$$T_j = 25^\circ\text{C}; I_D = 25\text{A}$$

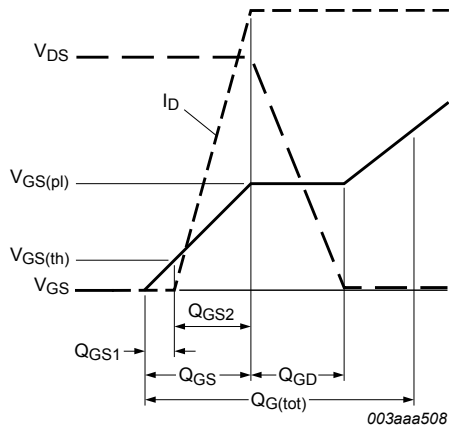


Fig. 14. Gate charge waveform definitions

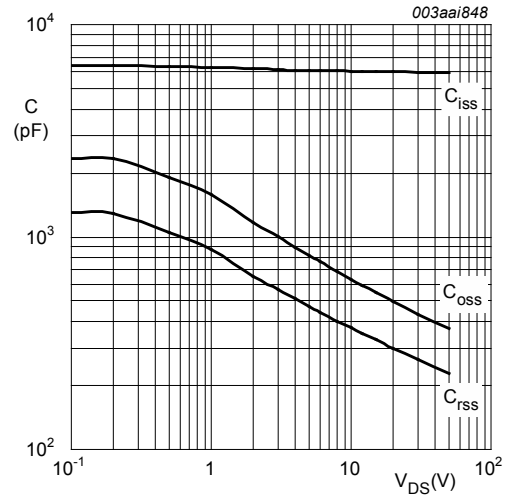


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

$V_{GS} = 0V$; $f = 1MHz$

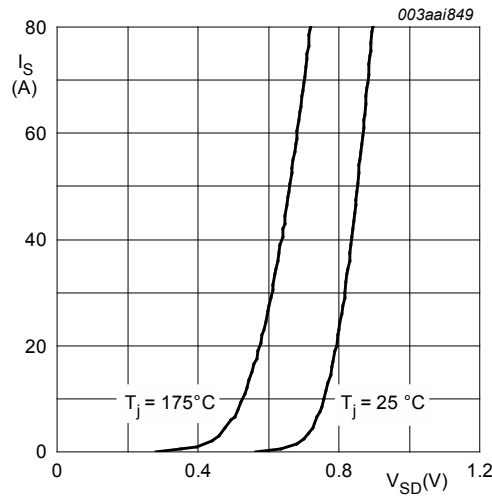
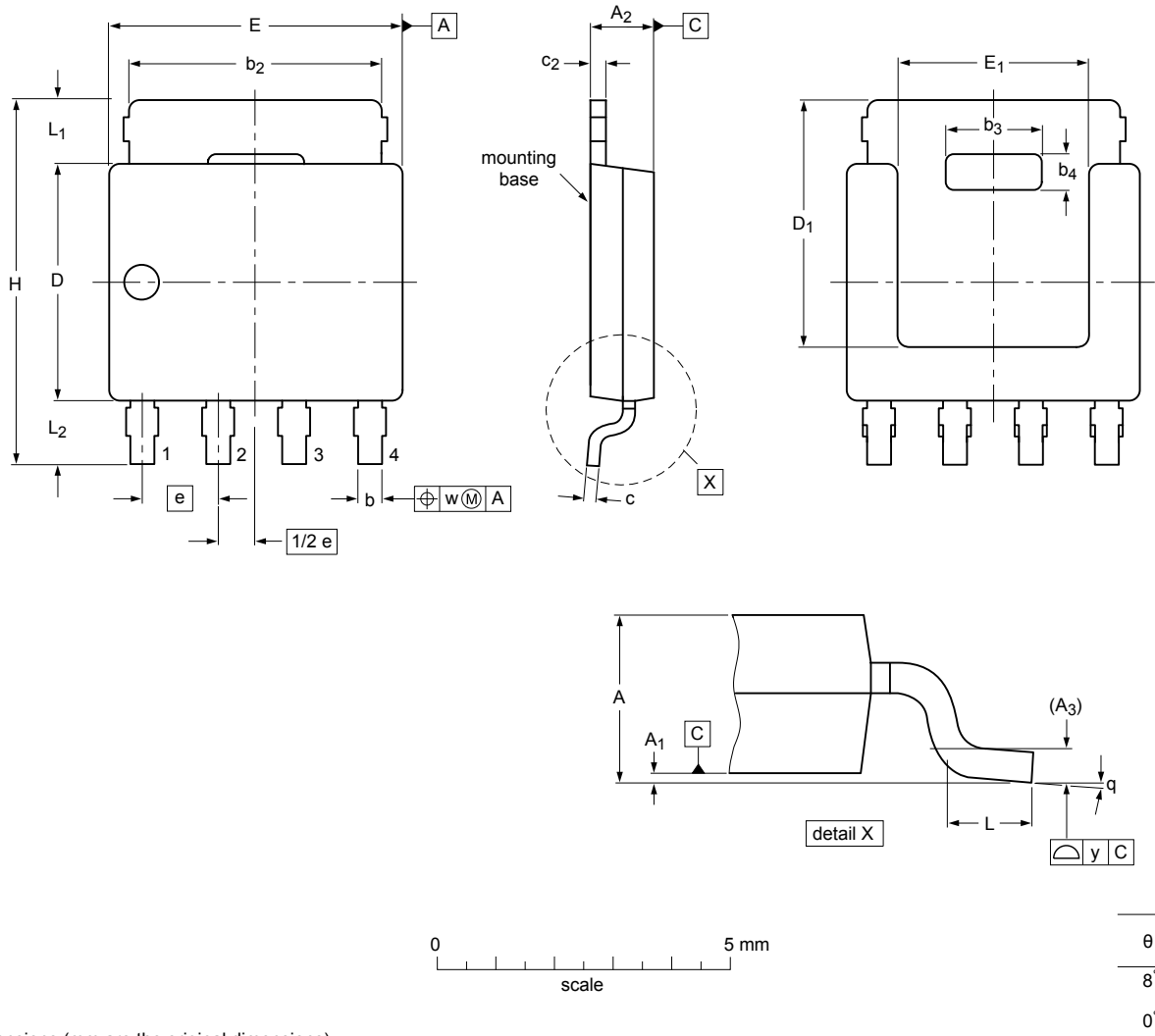


Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0V$

10. Package outline

Plastic single-ended surface-mounted package (LPAK56; Power-SO8); 4 leads SOT669



Dimensions (mm are the original dimensions)

| Unit ⁽¹⁾ | A | A ₁ | A ₂ | A ₃ | b | b ₂ | b ₃ | b ₄ | c | c ₂ | D ⁽¹⁾ | D ₁ ⁽¹⁾ | E ⁽¹⁾ | E ₁ ⁽¹⁾ | e | H | L | L ₁ | L ₂ | w | y |
|---------------------|------|----------------|----------------|----------------|------|----------------|----------------|----------------|------|----------------|------------------|-------------------------------|------------------|-------------------------------|------|-----|------|----------------|----------------|------|-----|
| max | 1.20 | 0.15 | 1.10 | | 0.50 | 4.41 | 2.2 | 0.9 | 0.25 | 0.30 | 4.10 | 4.20 | 5.0 | 3.3 | | 6.2 | 0.85 | 1.3 | 1.3 | | |
| nom | | | | 0.25 | | | | | | | | | | | 1.27 | | | | | 0.25 | 0.1 |
| min | 1.01 | 0.00 | 0.95 | | 0.35 | 3.62 | 2.0 | 0.7 | 0.19 | 0.24 | 3.80 | | 4.8 | 3.1 | | 5.8 | 0.40 | 0.8 | 0.8 | | |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

sot669_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|--------|-------|--|---------------------|------------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT669 | | MO-235 | | | | -11-03-25- 13-02-27 |

Fig. 17. Package outline LPAK56; Power-SO8 (SOT669)

11. Legal information

11.1 Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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